

Big Lake Water Quality Sampling as Related to Petroleum Hydrocarbon Pollution

2013 Draft Sampling Plan



The Alaska Department of Environmental Conservation



ARRI
Aquatic Restoration & Research Institute

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Background

- Previous water sampling has identified portions of Big Lake that are not meeting State Water Quality Standards for petroleum hydrocarbons (gasoline) during certain times of the summer months.
- Control measures to address water pollution are currently being implemented through the Total Maximum Daily Load (TMDL) plan.
- This Draft Sampling Plan outlines water quality monitoring that is being conducted to determine the effectiveness of implemented control measures at reducing the amount of gasoline in Big Lake.



A rainbow sheen on Big Lake is caused by gasoline coming from a carbureted 2-cycle boat engine. *Photo courtesy of Mat-Su Conservation Services.*

Oasis Environmental, Inc. performed water quality monitoring in Big Lake for the Department of Environmental Conservation (DEC) in the summer months of 2004 and 2005, and the data showed that areas of the east basin in Big Lake experience pollution from gasoline at levels above the allowed limits. Specifically, total aromatic hydrocarbons (TAH) from gasoline exceeded the water quality criterion of 10 micrograms per liter ($\mu\text{g/L}$) during certain times of the summer months. Based on these data, the DEC added Big Lake to the list of impaired waters in 2006. Additional water quality monitoring in 2009 verified the impairment listing and the gasoline pollution.

In 2012, the Environmental Protection Agency approved a Total Maximum Daily Load (TMDL) plan for Big Lake to address the gasoline impairment. The primary source of gasoline to Big Lake is motorized watercraft (boats and personal use watercraft) operating on high use weekends and near marinas, boat launches and other high traffic areas in the east basin. The gasoline can come from leaks and spills but most of it likely results from the combustion processes, which are designed to directly release unburned fuel out of the exhaust into the water. This is especially the case with carbureted 2-cycle motors.

Efforts to address the gasoline-related impairment in Big Lake are occurring. There is currently a coordinated effort with the Big Lake community and other local, regional and federal stakeholders implementing many actions listed in the Big Lake water quality action plan. Specific actions include development of a “Clean Boating Campaign,” which includes a program to talk to people one-on-one about pollution prevention, signs, educational materials, and bilge pads and socks for the treatment of bilge water. Actions also include encouraging Marinas to implement portions of the Alaska Clean Harbors program.



Clean boating education campaign logo. *Courtesy of Cook Inletkeeper.*

Project Need

- Monitoring Big Lake is necessary to determine if the implemented action plan is resulting in less gasoline entering the lake and improved water quality.
- If water quality is improving and meeting state standards, DEC can begin work to remove Big Lake from the list of impaired waters.
- Sampling over 4 days is necessary to determine if the amounts of gasoline decline after a busy weekend and the length of time fish are exposed to harmful levels of gasoline.

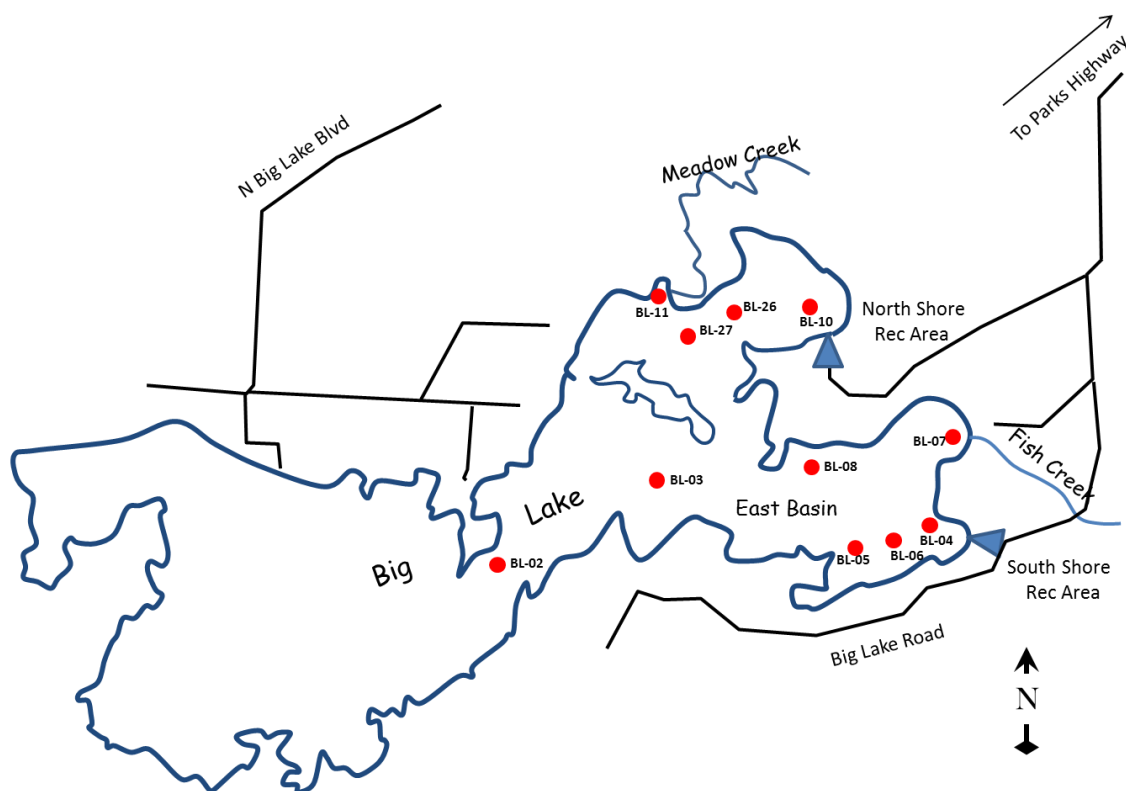


Figure 1. Location of proposed 2013 sampling locations shown by the red dot and abbreviated lake name (BL-) and the site number. Table 1 has contains descriptions of sampling locations.

Project Objectives

- Evaluate the effectiveness of increased public education programs and actions taken by residents and Marinas to reduce the amount of gasoline entering the lake;
- Evaluate changes in the amount of gasoline relative to previous sampling conducted at established sampling locations;
- Calculate daily and 96-hour average values and summary statistics; and,
- Evaluate changes in gasoline relative to the number of watercraft, motor sizes and motor type.

Sampling Locations

- Sampling locations are shown in Figure 1 and described in Table 1.
- Samples will be collected at locations used in previous studies to provide continuous and comparable values.
- Sampling locations are near high traffic areas and are those that during previous sampling often had high and low amounts of pollution.

Sample Collection Timing and Frequency

- Water samples will be collected on 9 sampling dates in late May – early July including over the Memorial Day holiday weekend, one Saturday in late June, and over the Fourth of July holiday weekend (see Table 2).
- Water samples will be collected at all sampling locations between 6:00 PM and 9:00 PM.
- At two sampling locations, samples will be collected 5 times on each sampling date: 9:00 AM, 12:00, 3:00, 6:00, and 10:00 PM so that samples can be collected prior to and following most motorized watercraft use and to provide an average daily value. This will also show how long the gasoline stays in the water over a 4-day period.



Sample Collection, Handling, and Analytical Methods

- All sampling will follow a stringent DEC Quality Assurance Project Plan with detailed sample collection, handling, and processing methods.
- Sampling locations will be accessed by boat with a 4-stroke inboard or outboard motor.
- Motor will be turned off for 10 to 15 minutes prior to sample collection and samples will be collected of the bow of the boat.
- Water samples will be collected below the water surface (approximately 6 inches) using a sampler designed by the U.S. Geological Survey for collecting water samples for analyzing volatile organic carbons (which include petroleum hydrocarbons).
- The sampler will be cleaned with detergent and rinsed using the public water supply on shore prior to collecting the first sample. The sampler will be rinsed three times at each site prior to each sample collection. Additionally, a sample will be collected from the public water supply using these same methods to make sure the sampler is not contaminating samples.
- The boat operator will not handle the sample bottles or touch the inside of the sampler, but will handle the rope and winch used to lower the sampler.
- Samples will be preserved with acid, placed within a cooler, held at approximately 39°F, and shipped to AM Test laboratory in Kirkland, WA for analyses.
- Samples will be analyzed for the petroleum hydrocarbon compounds of benzene, ethylbenzene, toluene, and xylene. The sum of these four compounds calculates the total aromatic hydrocarbons for comparing against state water quality criteria allowed limits.

Table 1. Sampling sites and descriptions.

Site	Description
BL-2	Major traffic lane between the two basins.
BL-3	Historical USGS sample site at the deepest area of the east basin.
BL-4	Center of the furthest east section of the lake near the South Shore State Recreation Site.
BL-5	Traffic lane for the bay to the southwest.
BL-6	Existing sample site near Southport Marina and residences.
BL-7	Near where Fish Creek drains from Big Lake. This is a popular fishing area as well as a high use traffic lane.
BL-8	Near Burkesshore Marina and residential development.
BL-10	Near the North Shore State Recreation Site. This area is heavily used for launching boats, swimming, camping, and personal watercraft operation.
BL-11	In the east basin near the mouth of Meadow Creek, the lake's major inlet. Serves as the sampling control site.
BL-26	Site located in the middle of the bay near the North Shore State Recreation Site. Site and west of location BL-10.
BL-27	Site located in the main traffic lane for users leaving North Shore State Recreation Site. Location will assess the area between the north bay and east basin.

Measures of Watercraft Use

- Watercraft will be counted from surveys conducted along transects through the study area every 3 hours throughout the day during sampling days. These surveys will provide an index of the number of motorized watercraft operating prior to sample collection.
- Additionally, watercraft on the lake will be counted on one day from an aerial survey. This count will be used to check on the accuracy of the surveys conducted by boat.
- Counts of use by watercraft type and motor type (2-cycle, 4-cycle, 2-cycle direct inject) will be obtained from the boat launch entrance booths. These counts will be used to estimate the percent of people using 2-cycle, 2-cycle direct injection, or 4 cycle motors.

- Stop action photography will be used to record launch activity at both the South and North Shore Public Recreation Areas when the booth is closed in order to determine the number of boats entering or leaving the lake in the early morning or late afternoon.

Study Results

- Results will be evaluated to identify the number of samples that exceed Alaska Water Quality Standards by sampling location, on a sample by sample evaluation.
- Results will be evaluated to determine if 4-day (96-hour) average values exceed Alaska Water Quality Standards.
- Results will be compared to previous sampling to determine if there is an increasing or decreasing trend in TAH (gasoline) concentrations.
- TAH concentrations will be evaluated relative to the number of watercraft by type, motor type, and motor size.

Project Reporting

- A draft report of the study findings will be prepared for DEC and the project results will be presented to the public at a community meeting. A final project report will be prepared for DEC and made available to the public.
- Field results will be entered into the state's water quality data tracking system.

Table 2. Number of water samples to be collected and analyzed for TAH (sum of benzene, toluene, ethyl-benzene, and xylene), at each sampling location on each sampling date.

Location	24-May	25-May	26-May	27-May	29-Jun	4-Jul	5-Jul	6-Jul	7-Jul	Total
BL-2	1	1	1	1	1	1	1	1	1	9
BL-3	1	1	1	1	1	1	1	1	1	9
BL-4	5	5	5	5	1	5	5	5	5	41
BL-5	1	1	1	1	1	1	1	1	1	9
BL-6	1	1	1	1	1	1	1	1	1	9
BL-7	1	1	1	1	1	1	1	1	1	9
BL-8	1	1	1	1	1	1	1	1	1	9
BL-10	1	1	1	1	1	1	1	1	1	9
BL-11	1	1	1	1	1	1	1	1	1	9
BL-26	1	1	1	1	1	1	1	1	1	9
BL-27	5	5	5	5	1	5	5	5	5	41
Duplicate Sample	1	1	1	1	1	1	1	1	1	9
Field Blank	1	1	1	1	1	1	1	1	1	9
Total	21	21	21	21	13	21	21	21	21	181